

and animals, was given by Mr. Ernest Hart at one of the many meetings which have been held on the subject, when he mentioned that wax manufacture had been, during the last twenty years, successively driven further and further from the centre of London. Ten years ago it was possible to bleach wax in the sunlight at Shepherd's Bush, but the factory was now removed to near Richmond, as it was found that the bleaching power of the sun for the greater part of the year was almost nullified by the pall of smoke which hangs over the metropolis. We shall not speak to-day of the various appliances of which we have as yet had but a hasty view, but it is only fair to say that there are shown at the Exhibition a number of grates, some of which, such as the new "Everitt" grate shown by Messrs. Barnard, Bishop, and Barnard; Mr. Crane's grate, shown by Deane and Co.; and in some respects the "Excelsior" grate of Mr. Archibald Smith, mark distinct advance. The possibility of consuming the smoke of bituminous coal in ordinary grates by forcing the draught of air and smoke downward through the fire before it is allowed to escape has been shown, as has also the facility with which hard anthracite smokeless coal will burn in open grates without any sort of blower or other such contrivance. In addition to these there is an extremely interesting series of exhibits of mechanical stokers, fire-bars for furnaces, a new gas-kiln which will be shown in operation, as well as Dr. Siemens' gas-regenerator. Some extremely good household stoves and fire-places are sent from Germany and Canada.

DOUBLE-STARs

Observations of Double-Stars made at the United States Naval Observatory. By Asaph Hall, Professor of Mathematics, United States Navy, and Rear-Admiral Rodgers, U.S.N., Superintendent. (Washington: Government Printing Office, 1881.)

WE welcome another addition to our knowledge of the positions and distances of double stars. Prof. Asaph Hall has published a volume containing 1614 observations of such stars made by him chiefly with the 26-inch refractor at the Naval Observatory at Washington. The objects of the observations are two. Firstly, the detection of constant errors of observations by the measurements of double-stars from a selected list, and comparing such measures with those of other observers made as nearly as possible simultaneously; and, secondly, the measurements of double-stars generally.

The list of stars adopted is that prepared by Otto Struve, with a few additions of stars of greater distance. There are 30 stars in all, and 296 complete sets of measures of these have been made, each set consisting of four measures of position and two double measures of distance, except in cases where the stars exceed 3" in distance, when four were taken. The measures appear to be made with care, and the discrepancies are not greater than may be expected from night to night.

In connection with this subject Prof. Hall has applied a geometrical test to such observations by means of measures of the multiple stars ≈ 2703 and ≈ 311 and the stars in the trapezium of Orion. He says:—

"In the case of three stars A, B, C, if we take the

origin of co-ordinates at A, and observe the angles of position and the distances of B and C only, then these quantities are independent, and we may put their differentials equal to zero. But if we observe also the angle of position and the distance between B and C we have obtained more quantities than the geometrical conditions require, and must adjust the parts of the triangle by the method of least squares."

In the case of the triangles and the quadrilateral there appear to be no important systematic errors.

Prof. Hall gives a detailed account of the use of "rough circles" for setting the instrument on a star. These circles are the edges of the ordinary setting circles divided by lines of black paint on a white ground so as to be read without trouble, a method already adopted in some observatories in this country. He also describes the difficulties he has had with the driving clock, difficulties which are too often experienced with driving clocks of all kinds, and often arising from insufficiency of power and strength of parts to stand varying strains, and often dust and damp, which ordinary clocks do not generally experience. The dome, which is 42 feet in diameter, now turns with more difficulty, and if our experience is worth anything, such a difficulty once commenced will keep on fast increasing, and will very materially militate against the continued use of the instrument beneath it. The flexure of the telescope, which is 31 feet in length, and of the mounting, is small, and the working of the instrument very satisfactory.

A filar micrometer has been used for all the observations, and great care has been taken to test its accuracy, which is all that can be desired; but we note that the wires are illuminated by a lamp held by an assistant, a method somewhat primitive, as Prof. Hall says, and a waste of energy which might, we should have thought, have been useful elsewhere.

In all the ordinary observations four measures of position and two double measures of distances have been taken, and in all cases the head of the observer was kept in an upright or natural position. Owing to this we shall expect to find, on comparison of the list of test stars with others, a considerable error depending on the position of the stars with the horizon. No doubt practice has a great deal to do with it, but we have generally understood that the observations were more accurate and differed less *inter se* when made with line joining the eyes parallel to that joining the stars under observation.

Prof. Hall has included a good many very close stars, and it is to them that the large telescope can be most profitably turned, leaving the wider ones for the small instruments, with which they are well able to deal.

OUR BOOK SHELF

Zoological Atlas (including Comparative Anatomy), with Practical Directions and Explanatory Text for the Use of Students. Invertebrata. By D. M'Alpine. 249 Coloured Figures and Diagrams. (Edinburgh and London: W. and A. K. Johnston, 1881.)

THIS Atlas is prefaced by the following remarks:—"In treating of the Invertebrata I have thought it advisable to depart slightly from the plan followed with the Vertebrata. There are five great divisions of Vertebrates recognised by naturalists, and a type or so of each was found to answer the purpose in view; but among Invertebrates the range of structure is immensely greater, and

the typical forms are thereby necessarily increased. In order to preserve the just proportions of the subject, and out of the whole make a fair selection, I have treated most of the forms in less detail than the Vertebrates." With the above statement no objection could be found; as to the method of carrying it out, we notice that while four out of the sixteen plates are devoted to illustrations of the group of Protozoa, there is not even a single figure given of the Sponges, nor of the Hydrozoa, nor of the Actinozoa, and for their absence we can find no other excuse than what is given in the above quotation. As to the plates of Protozoa, we perceive that there is no exact indication of the size of the forms figured, unless indeed in a footnote, which states that the forms figured "are all *microscopic*, with the exception of the Nummulites." Now if there is one thing more than another that a student requires to be reminded of while studying "microscopic" forms, it is that they vary immensely among themselves as to size, and it is surely necessary that he should have some definite ideas as to those sizes beyond the range of unassisted vision, such as he may be presumed to have of those objects within this range. Neither has the author been to our mind happy in his selection of forms of the Protozoa "from standard works on the subject." His Atlas is meant for students in this country, and where are they to get specimens to work with of such genera as *Protogenes*, *Vampyrella*, *Myxastrum*, *Protomonas*, *Proto-myxa*, *Lieberkühnia*, and the like. The student interested in "pond-life" may possibly admire the exquisite and artistic delineations of their old favourites, *Paramacium*, *Daphnia*, *Cyclops*, &c., given in the Atlas. The festooned surface of *Paramacium*, the appendages of *Daphnia* and *Cyclops* are certainly figured as they have never been heretofore. It is really refreshing to turn from the old and well-worn figures to the bold originality of these plates; in them the author has courageously followed the theory of zoological representation laid down by the celebrated German artist with reference to *Camelus*, sp., but is scarcely to be congratulated on the wonderful results he has achieved. Some of the diagrams are acknowledged as from the originals of Huxley and Gegenbaur; these are good.

The Student's Handbook of Chemistry. With Tables and Chemical Calculations. By H. Leicester Greville, F.I.C., F.C.S. (Edinburgh: E. and S. Livingstone, 1881.)

"In the presence of so many good manuals on chemistry, the appearance of another may seem unnecessary," says the author in his preface. For "may seem" read "is," and the sentence expresses a truism. The author's book can, however, scarcely be classed amongst "good manuals." The statements of individual chemical facts are on the whole correct; the general arrangement of the book is clear; yet, considered as a manual of chemistry, the work must be pronounced a failure.

Attempts are made to explain the expressions "atomic weight," "molecular weight," "valency," &c., but without success. Atoms are confused with molecules; the ordinary definitions of these terms are certainly stated, but definitions taken by themselves are, as Hunter said, "Of all things on the face of this earth the most cursed."

Avogadro's law is stated on p. 26, but the conclusion deduced therefrom, viz. "the densities of all the elementary bodies in the gaseous condition are the same as their respective atomic weights, or, the atoms of all the elements in the gaseous state occupy the same space," is untrue, and does not follow from the generalisation of Avogadro.

The Daltonian atomic theory is stated much in the terms which might have been employed before the molecular theory of matter had been propounded. Such statements as that on p. 15, that oxides are called monoxides, dioxides, &c., according "as the compounds contain one, two, three, &c., atoms of oxygen respectively"; or

that on p. 13, "that acids are spoken of as monobasic, &c., according as they contain one, two, &c., atoms of hydrogen replaceable by a base," show that the author has failed to grasp the teachings of the molecular theory.

The term "valency," we are told on p. 159, is used to express "the comparative saturating power of the different elements, taking hydrogen as the unit." Such a loose statement as this naturally prepares the way for the full acceptance of the "bond" view of valency, with all its inconsistencies and apparent, but unreal, explanations of facts; so that one need not be surprised to find (p. 160) the expression, hard to be understood by the uninitiated, "the affinity of these bonds."

A sentence on p. 161 may be quoted as a type of the kind of writing to be found in the works of those who are bound by the trammels of this pernicious system. "The disappearance of the active atomicity by twos, which is found to be always the case, has led Dr. Frankland to suggest that the bonds of union so disappearing are engaged in satisfying each other."

That part of the chapter on "The Higher Principles of Chemical Philosophy" which deals with compound radicals is equally unsatisfactory. Sulphuric acid may be assumed to contain the radicle SO_2 . "The group SO_2 may be traced all through the compounds of sulphuric acid, thus: $\text{SO}_2(\text{OK})_2$, $\text{SO}_2(\text{ONa})_2$, SO_2CuO_2 ." Such a statement is harmful, and only harmful, to the student; in what light other than as an amusing plaything can he regard this conception of compound radicle? Why should he not trace the group SO_3 , or the group SO , or the group SO_4 "all through the compounds of sulphuric acid"? Give him pen and paper, and if he have a little fancy he will trace you a most varied and pleasing number of groups "all through" as many compounds as you please.

The tabulation of facts concerning groups of elements and compounds is a good feature in this book, and likely to prove very useful to the student. The chapters dealing with organic chemistry are clear and succinct: had the author contented himself with recording leading facts, and left the "principles of chemical philosophy" alone, he would have produced a book of some merit, although not of merit sufficient to warrant him in adding another "Manual of Chemistry" to the list which is already so much too long.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

The "Eira" Arctic Expedition

THOSE who advocate the despatch of a Government vessel in search of Mr. B. Leigh Smith's expedition betray only a partial acquaintance with the circumstances of the case. His having failed to return this season is no evidence whatsoever of his having met with disaster; for previous to his departure from England, certain people well understood that he was prepared to spend the present winter far north if he found it worth while to do so. It was this which prevented me from going with him (natural history work on hand precluding my absence from London for upwards of a year); for as I had collected plants and animals with him on a former expedition in Spitzbergen, he invited me to accompany him on his present trip to Franz-Josef Land. The *Eira* was well-provisioned for upwards of eighteen months, and in summer time fresh meat in abundance can be secured, which, hung up in the rigging, will keep good for almost an indefinitely long period. Thus the expedition has provisions enough for at least another year and a half from the present time, and there would be no need for them to starve two years hence. It is therefore rather